



Independent Application & Weight-of-Evidence: A Historical Perspective, Including the Nuts and Bolts

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Some History (Part 1)

Pre-TMDL

- Most concerns focused on the use of biocriteria to assess/affect NPDES permitting decisions (e.g., WET, WQBELs)
- 305b/303d – almost an “anything goes” approach to listing (few effective “filters”)
- Chemical vs. bioassessment comparisons
- Some concerns about quality of assessments re: 1996 305b guidance, **4 levels of rigor**
- Pre-occupation with toxics & type I errors
- EPA policy reflected strict adherence to IA

Some History (Part 2)

Post-TMDL

- Concerns with “bad” listings
- Focus on numbers of listings (too many)
- NRC TMDL committee – call for better bioassessment and TALUs
- NRC TMDL committee – call for better “indicator discipline” and better M&A
- Focus now on assessment decisions at the waterbody scale
- Concerns still with type I error, but for different reasons – “unaware” of type II errors

Bioassessment/Biocriteria Milestones

- 1981: Karr and Dudley definition of biological integrity
- 1981: First EPA working group to address practical measurement of biological integrity
- 1983-4: Various regionalization projects use biota as the key endpoint of concern
- 1986: IBI procedure and regional reference sites
- 1987: EPA RBP manual
- 1987: First EPA National Biocriteria workshop
- 1987/90: Ohio and Maine adopt biocriteria in WQS
- 1990: EPA Policy on Biocriteria
- 1989/91: WQS 21st Century addresses biocriteria
- 1995: First assessment of state & tribal programs
- 1998: Vermont adopts biocriteria in WQS
- 2003: National Biocriteria Workshop
- 2002/5: EPA TALU process, workshops, CE process, etc.

Some “Quotable Quotes” From the Not So Distant Past

- “. . . (biocriteria) attempt to leapfrog state regulatory and enforcement programs well past the point of existing science.” (1993)
- “Biocriteria would be of little help to the NPDES program and may complicate permit issuance . . .” (1992)
- “. . . as waters improve, biocriteria will become more stringent leaving the regulated community on a never-ending merry-go-round of increasingly stringent requirements.” (1991)
- “. . . most states lack the resources and expertise to pull this (biocriteria) off.” (1997)

Some Past Issues & Concerns About Bioassessments and Biocriteria

- Not based on “hard science” like other criteria
- Results can be manipulated to affect outcomes
- Uncertainty about relationship with established criteria and regulations
- Not fully developed enough to use in management applications
- It can determine an impairment, but causes cannot be derived or inferred
- It costs too much

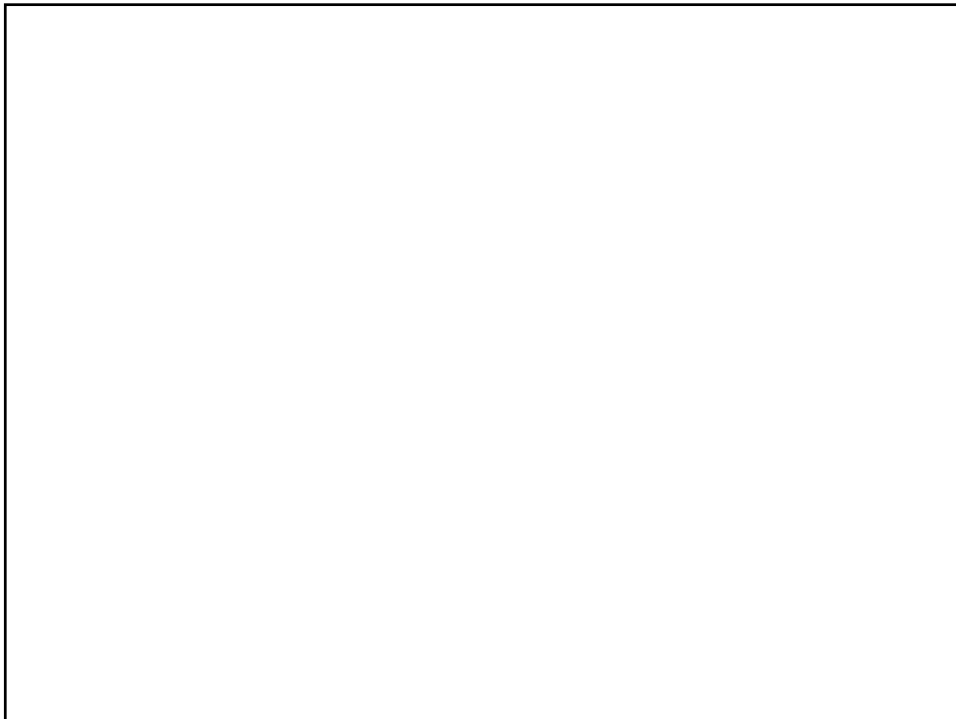
EVOLUTION OF ASSESSING SURFACE WATER INTEGRITY: ADDING NEW & BETTER TOOLS

WATER QUALITY —————> WATER RESOURCE

- | | | | |
|---|---|---|----------------------------------|
| • Simple Chemical Criteria | • More Chemical Criteria | • Complex Chemical Criteria | • More Complex Chemical Criteria |
| • One Aquatic Life Use
(1974 - 1978) | • Tiered Aquatic Life Uses
(1978 - 1980) | • Tiered Aquatic Life Uses
(1980 - 1987) | • Tiered Aquatic Life Uses |
| | | • Narrative Biological Criteria | • Numerical Biological Criteria |
| | | | • Whole Effluent Toxicity |

The tools to assess biological condition & perform assessment have outpaced policy

LESS ACCURACY —————> MORE ACCURACY



The “Law of Unintended Consequences”

We need a management framework that --

- Targets actions to achieve **environmental results**
- Fosters setting ecologically sound **goals**
- **Measures** and **communicates** what we've accomplished

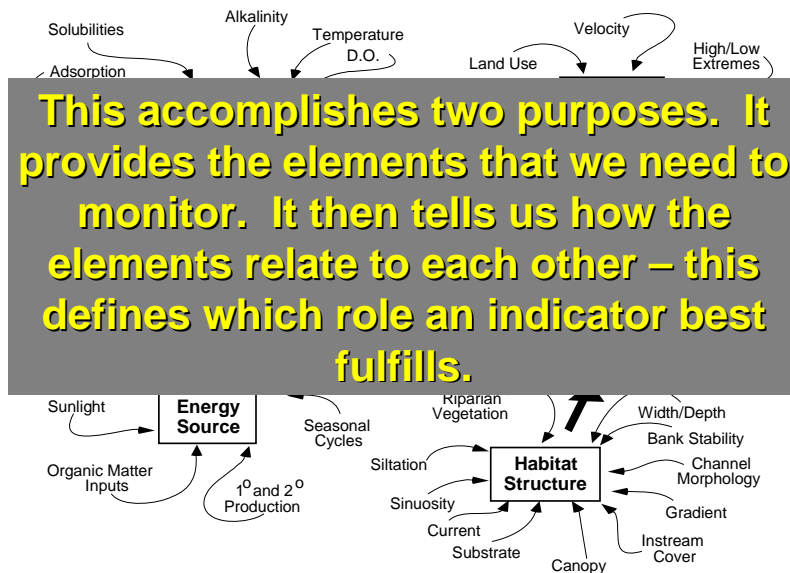


TALU provides the tools

Use of Biological Information to Tier Designated Aquatic Life Uses in State and Tribal Water Quality Standards

Available August 2005

The Five Major Factors Which Determine the Integrity of Aquatic Resources

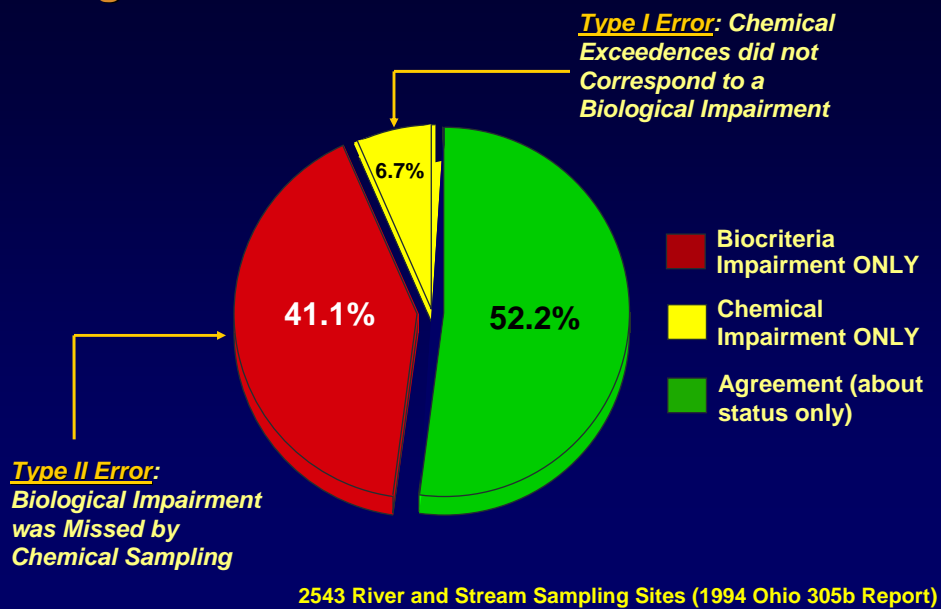


Types of Environmental Indicators: How Each is Used Makes a Difference

1. **Stressor Indicators** (pollutant loadings, land use, habitat) – *best used to indicate impacts*
2. **Exposure Indicators** (e.g., chemical-specific, biomarkers, toxicity tests) – *best used to indicate risk of harm or undesirable changes*
3. **Response Indicators** (e.g., biological community condition) – *best used to indicate whole effects and as a performance end-point*

Problems occur when indicators are used as surrogates outside their most appropriate role

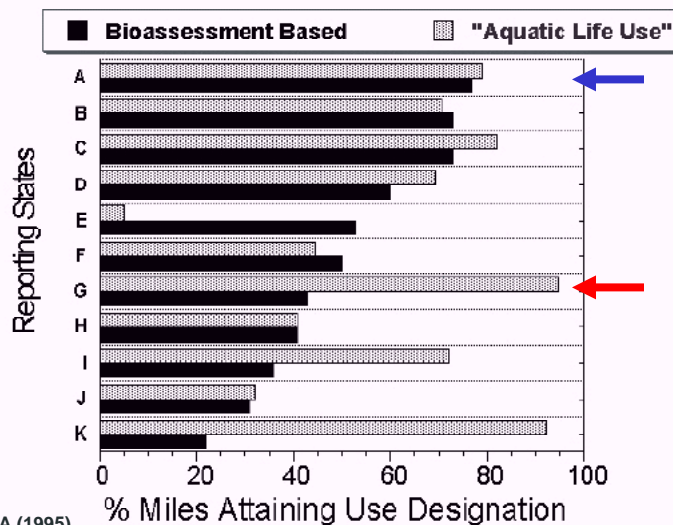
Consequences of Improper Indicator Usage: The Risk of Assessment Error



Surrogate Indicators Propagate Errors in the Assessment Process

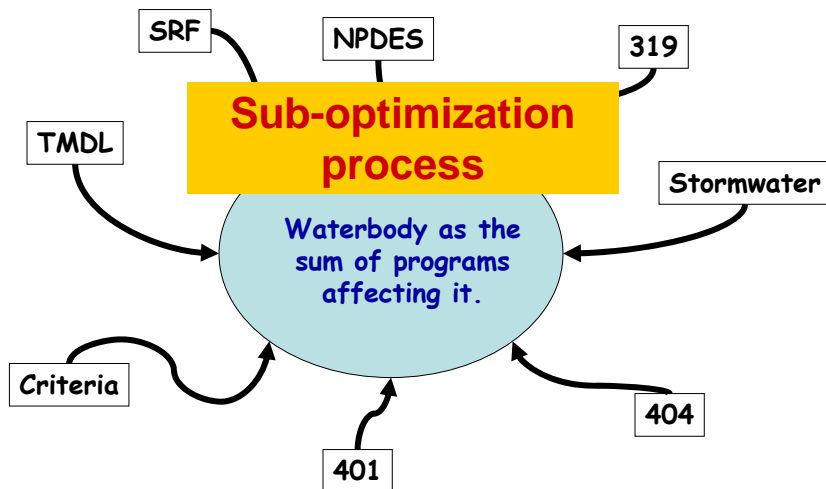
- Chemical assessments are **highly prone to type II error propagation** – what are the consequences to watershed management?
- If we continue policies that instill a disincentive to upgrade bioassessment programs because of a preoccupation with type I errors, there is a real risk of perpetuating the net loss in aquatic resource quality.

Comparison of 305b Reporting Between States:
Aquatic Life Use Attainment



Source: U.S. EPA (1995)

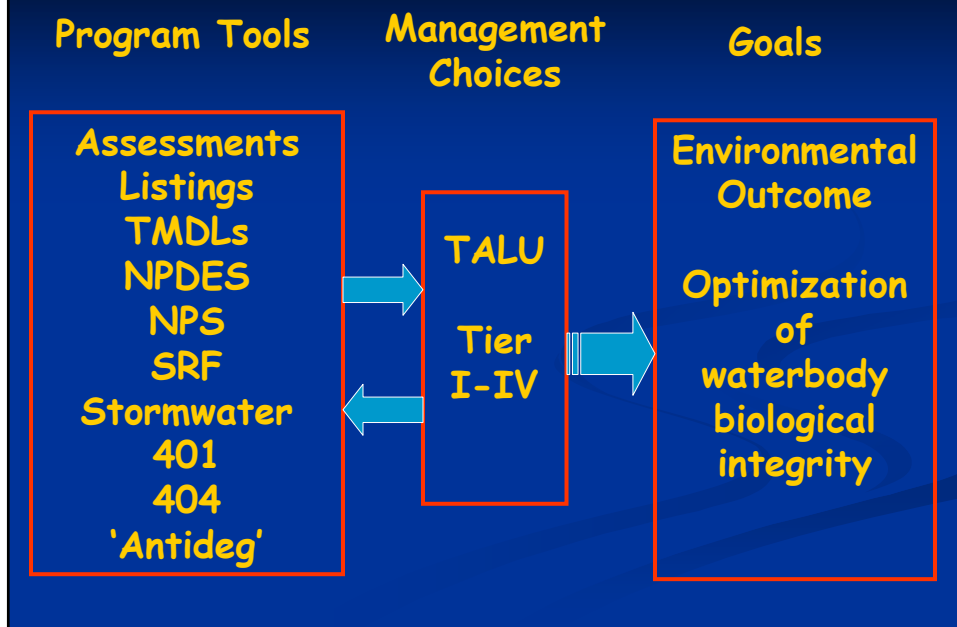
Impact of “Conventional” CWA Programs



Symptoms of An Incomplete Foundation for WQ Management

- General or “colloquial” uses and criteria
- Reliance on prescriptive policies
- Acceptance of anecdotal information
- “Hand-offs” in the assessment process
- Point source “culture” & translation of concepts to TMDLs and NPS
- Reported statistics fail “straight face” test
- Gross dissatisfaction with program outputs (e.g., recent TMDL experiences)

Optimization process



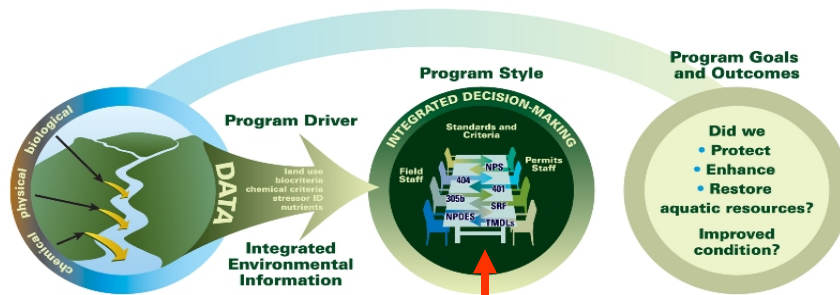
An Integrated Approach to Water Quality Management

Water Quality Based Bioassessment Based

- | | |
|--|--|
| <ul style="list-style-type: none"> • Parameter specific criteria • Surrogate assessment • Pollutant focused • Partial coverage • Bottom up approach • Individual effects • Stress/exposure indicator • Design criteria | <ul style="list-style-type: none"> • Biological criteria • Direct assessment • Resource focused • Complete coverage • Top down approach • Cumulative effects • Response indicator • Impact assessment criteria |
|--|--|

Integration of both approaches is needed to assure protection of water resources

Desired Approach: Manage for Environmental Results



How WQ Management Programs are Organized and Operated is Equally Important - We Must Better Merge M&A and WQS

States Evaluated Since 2002-4:

Region I: CT, ME, RI

Region IV: AL

Region V: IL, IN, MI, MN, WI, OH

Region VI: NM

Region VIII: CO, MT

Region IX: AZ

plus Selected Tribes

Measures the rigor of the bioassessment program

Ed Hammer, USEPA/Region 5
Tina Laidlaw, USEPA/Region 8
Gretchen Hayslip, USEPA/Region 10

Key Concepts

Accuracy: Biological assessments should produce sufficiently accurate delineations to minimize Type I and II assessment errors.

Comparability: technically different approaches should produce comparable assessments in terms of condition ratings, impairments, & diagnostic properties.

Comprehensiveness: biological response is evaluated in conjunction with other stressor/exposure information to understand the key limiting factors.

Cost-Effectiveness: having reliable biological data to support management decisions outweighs the intrinsic costs of development and implementation (NRC 2001).

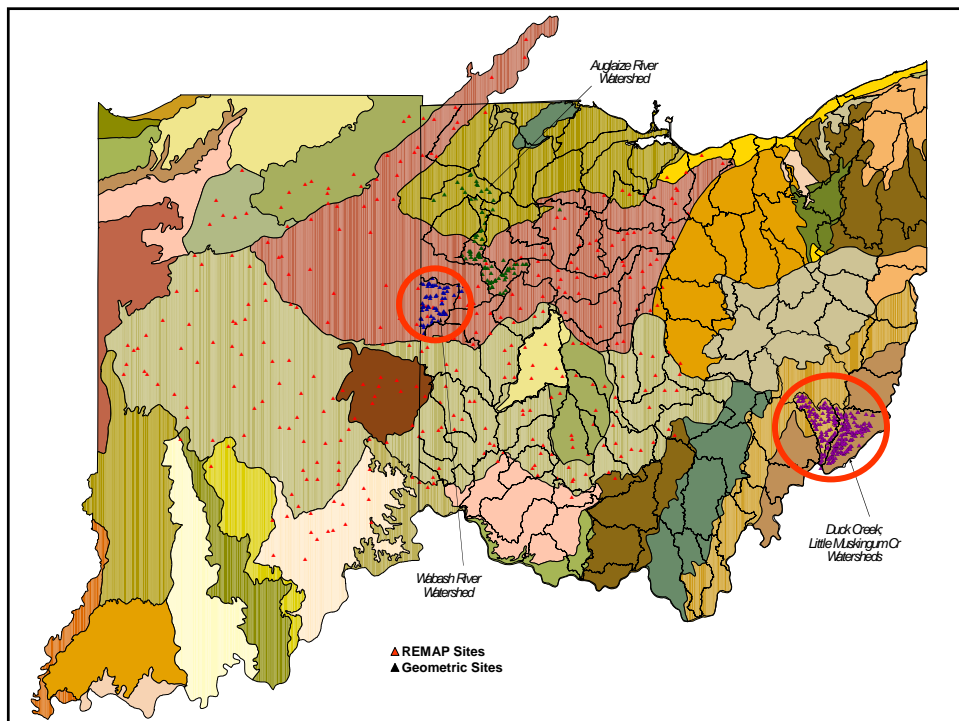
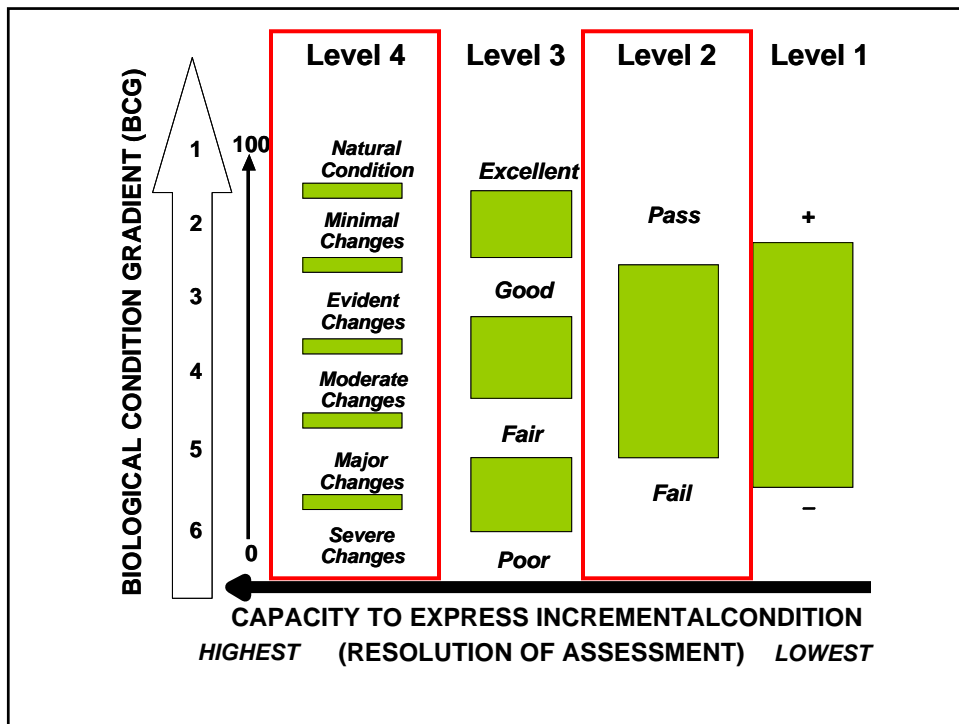
What Do the Levels Mean?

Level 1 produces general assessments - not amenable to supporting most tasks *i.e.*, status, severity/magnitude, causal associations.

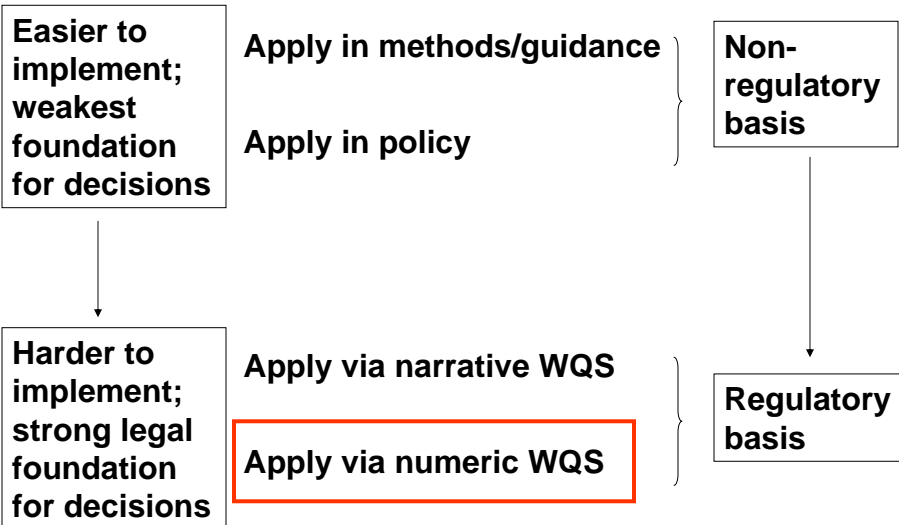
Level 2 includes pass/fail to multiple condition assessments (3-4 categories); capable of general causal determinations.

Level 3 is capable of incremental condition assessment along the BCG and for most causal associations; single assemblage limitations.

Level 4 provides full program support & reasonably robust, accurate, & complete assessments including scientific certainty, accuracy, relevancy of condition, severity & extent, and causal associations.



TALU and Biocriteria Options



We Also Need Explicit Implementation Provisions

Rule language that addresses:

- 1) *What are management options when biocriteria determine attainment of a TALU?*
- 2) *What are management options when biocriteria determine non-attainment?*
- 3) **L4 programs** are best positioned to provide the desired certainty.

We Also Need Training

Why?

- 1) Most "decision makers" are not well versed in the scientific underpinnings - process is laden with 1970-80s era presumptions*
- 2) TALU is an integrated process that challenges the relative simplicity of 1970-80s era EPA criteria science & the policies that followed (most of which have not kept pace)*

Administrative Output vs. Resource Outcomes Based Management

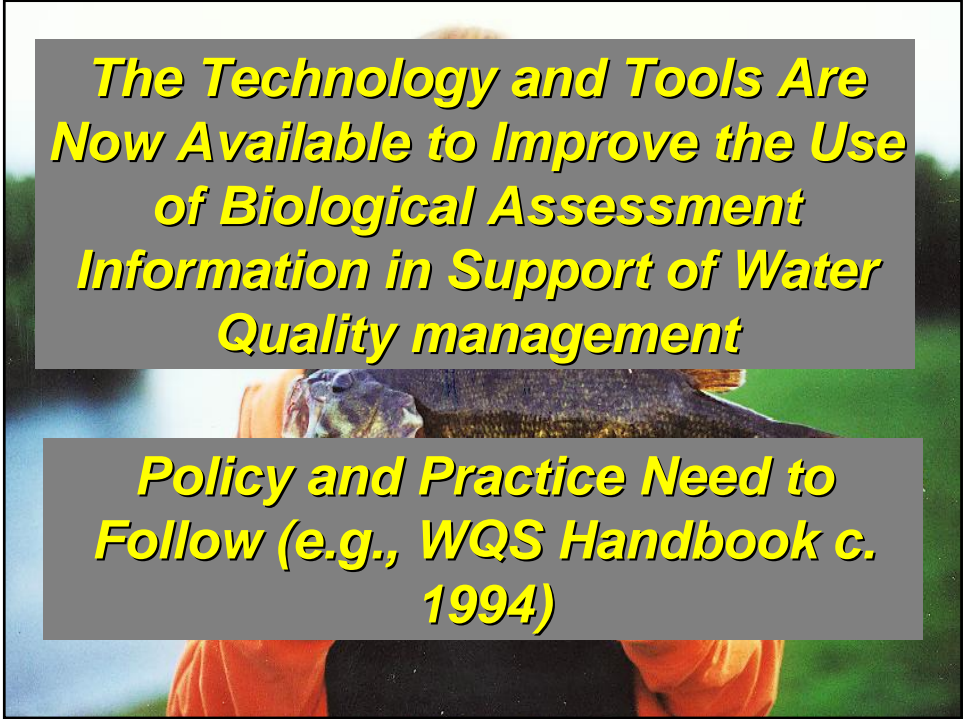
	ADMINISTRATIVE OUTPUTS BASED	RESOURCE END OUTCOMES BASED
Goal:	Program Performance (Program execution)	Environmental Performance (Attain designated uses)
Measures:	Administrative Actions (Lists, Permits, Funding, Rules)	Indicator End-points (<u>Biological</u> , Chemical, Physical)
Results:	Improve Programs (Reduce backlogs, improve timeliness)	Programs are Tools to Improve the Environment (Admin. outputs evaluated by environmental end outcomes)

TALU Fosters Effectiveness Based Programs

"If you don't know where you are going, you end up somewhere else."

Yogi Berra

<http://www.rinkworks.com/said/yogiberra.shtml>

A person wearing an orange shirt is holding a large, dark-colored fish, possibly a catfish, against a green background. The image is partially obscured by two text boxes.

***The Technology and Tools Are
Now Available to Improve the Use
of Biological Assessment
Information in Support of Water
Quality management***

***Policy and Practice Need to
Follow (e.g., WQS Handbook c.
1994)***